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Engaging effectively with public(s) in the realization of CCS projects

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Abstract

Achieving climate neutrality of the EU's economy and society is a central goal of the European Green Deal. The decarbonization of our societies involves, amongst other things, the adoption of many new technologies and the construction of associated infrastructure. Carbon capture and storage (CCS) and marine renewable energy (MRE) are two suites of technologies widely seen as key elements of climate change mitigation. However, the deployment of infrastructure required for decarbonization such as CCS & MRE have often been met by high-profile public opposition, especially in relation to specific developments [3]. The social acceptability, and by extension public acceptance, of strategic infrastructure development, such as CCS & MRE can be greatly facilitated and encouraged by engaging with the public in meaningful and constructive ways, especially through appropriately designed education and public engagement programs. This paper examines what constitutes effective means of engaging with the public on such issues. It draws from critical reviews of education and public engagement (EPE) programs undertaken in the context of two research projects one focused on carbon capture and storage and the second concerned with marine renewable energies.

Keywords: decarbonization; civil society; public acceptance; acceptability; engagement; education; epe

1. Introduction

1.1. Background

There are pressing environmental, societal, and increasingly socio-political drivers for decarbonization. Within the EU we have set ourselves the target of being climate neutral by 2050. This goal in effect means near complete decarbonization of our society over the coming 30 years. This will both cause (and necessitate) significant changes in the way we arrange our societies and how we live our lives. Central to this societal and economic transformation will be the adoption of many new technologies and the construction of associated infrastructure, both within the energy system and other carbon intensive industrial processes. The deployment of novel infrastructure required for this decarbonization can only be successfully realized through social acceptance [1].

Carbon capture and storage (CCS) is widely seen as a key component for climate change mitigation. It has been identified as a key technology in the EU's move towards a circular economy [2] and given supportive regulatory

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context as it is considered a cost-effective component of a portfolio of greenhouse gas mitigation measures [3]. However, while CCS is seen as offering potential environmental and economic benefits, there has been high-profile public opposition, especially in relation to specific developments [4]. Whilst the primary focus of the planning and implementation phases of CCS projects might be on the technical and geological aspects, there is increasing acknowledgement that the social dimension can be crucial in the development and realization of such projects [5]. It is noteworthy for instance that the significant public opposition to the Barendrecht CCS project, which contributed to the project being cancelled, is seen in part at least, as a ‘public engagement failure’ [6].

Marine renewable energies (MRE), including offshore wind, wave, and tidal energy, are considered to have an important role to play in decarbonization through contributing to reducing the carbon intensity of energy generation and supply. As a nascent technological sector, MRE also face potential public opposition to their deployment. While opposition to large scale infrastructure will always be a potential issue, there is growing concern that public opposition to infrastructure related to renewable energy is of such a scale that it is threatening the envisaged decarbonization [7].

1.2. Why engage the public?

Preventing (or overcoming) social opposition to strategic infrastructure development – including deployment of novel technologies such as carbon capture and storage and marine renewable energies – requires developing societal buy-in to some degree. This means acceptance by the public generally (of the technology), but also, and more critically, acceptance by the communities set to host such infrastructure. Moreover, we suggest that realizing the necessary infrastructure at scale requires not just ‘social acceptance’ by host communities and society at large, which often implies acceptance of something imposed, a passive acquiescence so to speak. It also, and more importantly requires ‘social acceptability’ of the novel technology and specific proposed deployment projects. This implies *‘not just public acceptance of decisions but also public acceptability within the decision-making process i.e., what might be described as fairness’* [8].

It has become the norm in recent decades for greater public involvement in environmental and planning decision-making. Such participation has taken a number of forms *e.g.*, public hearings, education, information dissemination, public advocacy and advisory boards [9]. This has been described as a shift from a so-called DAD approach, ‘decide-announce-defend’ to a more inclusive and responsible approach summarized as ‘consult-consider-modify’ [10]. It is important to note that this engagement is not only important in the realization of individual projects, but also for improving the image of, and widening public support for, a particular technology or sector [11]. Accordingly, the public’s experiences with one project (and particularly when negative) will inform responses to subsequent projects associated with similar technologies or promoted by the same companies [9]. The impacts of poor public engagement will not be limited to a particular location, community groups are increasingly involved in (both informal and formal) networks and the experiences of one group will quickly be shared.

However, it is fair to say that attitudes towards renewable energy deployment (at least) often follow a U-shaped curve with high community support in principle, declining during construction and increasing again once operational [12], and so local opposition may not always be intractable or insurmountable. Although it should be noted that the inclination of some infrastructure project promoters to *‘invoke perceived popular support ... at national level to overrule the local concerns at project implementation stage’* only serves to impede community relations. This not only impacts the public acceptance of a specific project but will also affect attitudes towards subsequent projects [13].

The experience in the renewable energy sector of decline in support during the implementation phase following by increased support during operation, would indicate that not all opposition is due to the infrastructure itself and that at least some is related to perceived injustices in the decision-making processes [14]. Effective education and public engagement (EPE) programs can contribute to addressing many of the challenges of towards achieving both host community and wider societal acceptance to deployment of infrastructure such as that associated with CCS and MRE. EPE can be said to have three principal motivations [15]:

- Normative: the idea that projects should involve those individuals who have a stake in the decision.
- Substantive: a belief that involving the public will improve the decision-making quality by incorporating diverse knowledge.
- Instrumental: used as a tool to achieve a specific goal, including *e.g.*, increase acceptance, or foster trust.

As Smith, Stirling and Berkhout (2005) comment: ‘*under a normative view, participation is just the right thing to do. From an instrumental perspective, it is a better way to achieve particular ends. In substantive terms, it leads to better ends*’ [16]. This paper examines what constitutes effective means of engaging with the public on such issues. It draws from critical reviews of EPE programs undertaken in the context of two research projects: REALISE, focused on carbon capture and storage [10, 17] and SafeWAVE, which is concerned with marine renewable energies [18].

2. Methodology

2.1. Introduction

As mentioned in the introductory section, the work presented in this report draws from two reviews of education and public engagement practice with respect to CCS and MRE infrastructure. The reviews involved a case-study approach involving a detailed investigation of specific sites using multiple evidence sources to facilitate illustrative generalization of lessons learned. This research approach for these case studies involved an extensive review of the literature (relevant to the case studies and their host communities), combined with in-depth interviews with targeted informants (conducted via video conferencing). The resultant interview notes were then analyzed using a thematic analysis method.

2.2. Case selection

In each review, prospective cases were identified through a preliminary evaluation of literature and through partners’ research networks. Inclusion criteria for the case studies included: socio-political context; diversity in outcomes; accessibility of literature; and the availability of potential informants. EPE associated with 13 cases was reviewed, comprising: 4 CCS, 7 MRE, and 2 from other sectors – each of which contributed useful insights into EPE activity.

- CO2CRC Otway, a small pilot CCS demonstration project in Victoria, Australia. Consultation has been a strong focus of the project process from the outset [19].
- Jämschalde, a proposed CCS project in Brandenburg, Germany which did not proceed. Notable for its outreach efforts, but the proposal would seem to have fallen foul of a national mood turn against CCS [20].
- Barendrecht CCS Project in the Netherlands cancelled in 2010. Often given as an example of how poor communications and public engagement strategy contributed to growing public opposition [21].
- Tomakomai CCS Demonstration Project in Japan offers an interesting case study in how CSS- related projects can benefit from identifying and engaging with key local stakeholders as early as possible [22].
- San Cristóbal Mine, a silver lead and zinc mine in Bolivia operational since 2000. While not a CCS or MRE project, it offered a number of insights on how large-scale projects engaging in EPE and the issues that can arise.
- Energy Recovery Facility, Portsmouth, Hampshire UK, the engagement process of which was based on deliberative ideals and has been described as being “highly innovative” [23].
- Block Island Wind Farm, the first commercial offshore wind farm in the USA incorporated ‘bi-directional deliberative learning’ in its planning process [24].
- Wave Hub is an offshore renewables ‘plug-in-and-test’ pre-commercial facility in Cornwall, UK. An interesting element was the creation of internet forums that facilitated discussions between supporters and opponents [25].
- Mutriku Breakwater Wave Plant, located in the Basque Country, northern Spain, is Europe’s first commercial wave plant, with installed capacity of 296 kW. Growing opposition due to its noise impact led the developers to refine their engagement strategy [26].
- Pentland Firth and Orkney Waters is an area under pressure from new marine activities and especially from marine renewables. A preparation of a non-statutory pilot spatial plan for the area was commissioned to inform licensing process for new developments. The consultation initially attracted a lot of participation, but within a couple of years so-called ‘consultation fatigue’ had set in [27].

- Biscay Marine Energy Platform (BiMEP) is an infrastructure site located off the coast at Arminza, Spain designed to test prototypes of ocean energy. Recent discussion about offshore wind have raised fears as this is a special protection area for birds.
- SEM-REV is a marine energy test site is located 20km off the coast from Le Croisic, in Pays de la Loire, France. An information center is to be installed by a local University and managed by the council to inform about new offshore wind technologies to be tested on the site.
- The Aguçadora test site in Portugal is available to technology developers for research and project demonstration purposes. Public demonstration was a government-led process in which developers are not involved.

2.3. Review of literature

Literature reviews are an important part of the research process. In these reviews of EPE the objectives of the literature were twofold, namely, to develop an understanding of EPE programs generally, and to characterize the selected EPE case studies in so far as possible. Database searches were created using keyword search constructions comprising words, phrases and basic Boolean operators. The objectives of the reviews lent themselves to the relatively narrow initial definition of literature, while the subsequent usability and quality screening (*e.g.*, reputable source, accessible, obtainable, methodologically appropriate) resulted in a more focused review of a manageable size.

The collected literature was inputted into a reference management software, which made for a very user-friendly workflow enabling efficient reading, notetaking, and organization of documents. The review of literature itself comprised the familiar iterative process of searching, reading, annotating, organizing, summarizing, analyzing, and finally synthesizing [28]. The literature review was supplemented and complemented by semi-structured interview with key informants which offered insights not necessarily obtainable through a fully literature-based analysis.

2.4. Semi-structured interviews

During the initial scoping exercise and the aforementioned literature review, potential informants were identified for the different case studies. The context of Covid-19 meant that engagement had to be remote. Although this arguably may have had an impact on the effectiveness of the interviews, it meant that geographic location was no longer such a limiting factor, and there was the unexpected advantage that potential informants were more accessible (having greater availability during that time, and perhaps even an attraction to take part in a social interaction).

The informants were engaged using the semi-structured interview method. The objective of a semi-structured interview is to understand informants' perspectives. Informants are afforded sufficient time and scope to allow them to tell 'their story', albeit within a focal topic as a guide. In the semi-structured method, the interview is treated as a conversation and the researcher tries to develop a rapport to encourage the flow of conversation [29].

Following the semi-structured interview methods, the interviews (17 in total) were carried out using pre-formed, concise, easily understood, open-ended questions. Informants were invited to talk about the case study with which they were familiar. Prompts were used as required to guide the conversation. This included queries around *e.g.*, EPE approach adopted, relationship building, structure of engagements, addressing concerns of citizens, lessons learned. Extensive notes were taken during the interviews, where possible and when permission was given recordings were used to supplement and enhance the notes – the interview notes were analyzed through a qualitative data analysis technique known as coding.

2.5. Data analysis and interpretation

The analysis of qualitative data such as interview transcripts is a laborious and time-consuming process comprising reading, analyzing and interpretation. The method used in these reviews commenced with an initial read-through of the interview notes to aid familiarization, next the text was carefully analyzed to capture key information, identifying themes relevant to EPE activities. Emerging information was cross-referenced with and linked to that from the literature review, filling some knowledge gaps and identifying others. The notes were thematically analyzed, which involved the systematic ordering, categorizing, and coding (labelling) of text. In each case the researcher who interviewed the respondent also analyzed the notes, which greatly abbreviated the analysis process.

3. Towards effective engagement

3.1. Lessons from case studies

A number of challenges were identified across the 13 EPE case studies explored, in addition to good examples of practice, lessons to be learned and opportunities for improvement. Drawing from this analysis, some examples of good practice for dealing with citizens and communities' groups in the context of education and public engagement programs are presented below:

- **Early engagement:** A major shortcoming in a lot of EPE activity is to view it as unidirectional communication, to see it simply as a means of educating the uninformed and persuading the public to accept something that is for the greater good, however that may be defined. It is no surprise therefore that it remains all too common for public engagement on infrastructure to only commence once all the significant decisions have already been made. Early and open channels of communication with the public help build mutual trust between developers and citizens. Ideally local communities should be involved early so they can take a degree of ownership in the project. Treating local communities like partners in the EPE (where local concerns can be and are seen to be taken seriously) can result in significant goodwill [30]. Early engagement allows developers to explore the values, needs, and perspectives of citizens so they can be reflected, or at least considered, in the project.
- **Hiring trusted liaisons:** engaging locally known and trusted personnel in EPE programs has proven a successful method for gaining public support. While it is often argued that this is not scalable, the experience of Tomakomai CCS project for instance would suggest otherwise. The use of a staff member who was a known entity in the area proved useful in building initial contacts and developing relationships with the local community [22].
- **Use of informal direct communication:** The use of both formal and informal modes of communication can be beneficial and could act to short-circuit potential issues. In projects where communication was limited to formal processes, this acted as a barrier to identifying potential conflict points early on and prevented potential solutions from being quickly implemented. Case studies which demonstrated the highest success rates of public engagement all had informal communication channels that could feed into the development process. This blended (informal and formal) communication approach can foster a so-called '*chain of trust*' between the developers and the citizenry [31].
- **Building trust:** Developers must (at least at some level) be trusted by the community they are working with. Otherwise, any messaging they wish to convey may be open to hostile interpretation by those receiving it. Efforts should therefore be made to establish relationships and demonstrate they are responsive to the concerns of local citizens from the very start. This involves admitting when mistakes are made and offering solutions in a collaborative way to address those mistakes. In cases where an initial bad impression was made, any action taken by the developers (or others) was likely to be interpreted as hostile by the local community who were suspicious of motives. For example, when the Dutch government set up an information center in Barendrecht to provide neutral information, local residents believed they were a marketing tool to promote the CCS project.
- **Provide high quality tailored information:** A key challenge for a developer is to communicate and engage with the public in a manner that engenders the credibility of both the project itself and the developer. The information supplied to the public should be of high quality and tailored to their culture and context to have the greatest impact. In the Tomakomai CCS for example, a culturally responsive approach adopted was further complimented by a sustained educational outreach program that: outlined wider contexts informing CCS development (anthropogenic climate change); provided accessible literature on the CCS; and demonstrated recent working examples of its efficacy and safety [22]. In contrast while the information supplied about the Barendrecht CCS project was very detailed, it was not presented in accessible language or in a way understandable by non-experts [32].
- **Frame CCS within climate change context:** Perceptions of, and attitudes towards, CCS are influenced by the framing provided [15]. CCS should be discussed along with any available alternative energy technologies, and the larger socio-environmental context to CCS should be made known. Those most concerned about climate change often see a technology such as CCS as simply extending the life of fossil fuels. This argument was used by those opposed to the proposed Jämschwalde CCS plant in Germany. Alternatively, framing CCS as a bridging technology that will not discourage investments in renewable technologies can address such concerns about and

can have a positive effect on people's attitude. Of course, once again it does come down to the credibility of those providing the information and trust people have in them.

- **Keep discussions respectful:** This is especially the case when opposition arises. In the Barendrecht CCS demonstration project for example, proponents of the project considered questions regarding the necessity of CCS and available alternatives to be irrelevant, and sometimes deemed concerns about safety to be emotional or irrational [32]. Such invalidation of the concerns of the "other side" undermines the potential for establishing trust and developing positive relationships. If the public perceives they are not being listened to, they will mobilize and use alternative means of having their voices heard.
- **Honesty about motives:** There is a temptation to want to present the case in the best light possible and hyperbole is often used. For instance, during the initial information meetings about Barendrecht, developers suggested that the only lessons to be learned concerned legal procedures and monitoring. While the environmental impact assessment mentioned technological uncertainties, this undermined the developer's narrative. Furthermore, they maintained that they had no monetary motivations, which was simply not believed by the local communities. In such scenarios, skepticism can see opposing parties questioning the integrity of each other, and in a worst case leading to a break-down in communication.
- **Past experience is no guarantee:** While acceptance has often been higher in areas with a history of extractive industries due to potential economic opportunities past experience does not guarantee acceptance of CCS. In one case, many locals felt that when it came to the proposed demonstration project, the town had '*done enough for projects of national importance*' and shouldn't have to endure yet another activity offering few, if any, local benefits [33]. Another example of how it is important to understand the audience and to tailor the message.

3.2. Using these lessons

The REALISE project is working towards demonstrating a '*refinery-adapted cluster-integrated strategy to enable full-chain CCUS implementation*'. One of its aims is to increase the public acceptance for CCUS process and to improve the perception of the refinery sector [17]. To this end, the developed knowledge described above forms the basis for an EPE program being developed (in consultation with community stakeholders) in Cork, Ireland. The program under development is leveraging the experiences of the cases studies in the critical review(s) and will be informed different dimensions of acceptability (e.g., personal and interpersonal, community, structural political) adapted from social acceptance models [34, 35]. It aims to take an intersectional approach considering socio-demographic specificities such as gender; economic privilege; and life stage. Accordingly, developing an understanding of the focal communities is considered important. Such knowledge will be used to specify the EPE program, such that it is appropriately tailored to meet the needs and expectations of its targeted audiences. During the program design, elements will be trialed in local communities as a means of evaluating effectiveness, identifying areas for improvement, and to ascertain its transferability. The details of this work and the outcome of it trialing will be published as a project 'deliverable' once complete. Additionally, it is hoped to use the experience of this work and the knowledge developed to produce a framework for public engagement further enhancing the transferability of the developed approach to EPE

4. Conclusions

The success or failure of EPE in each of the case studies was a result of the specific and complex intertwining of the specific external and internal factors present in the cases. However, there are some commonalities found in cases with a positive outcome, for example: identification of key stakeholders; early and informed engagement; developing community connections; hiring local talent; use of both formal and informal modes of engagement; and above all, the value of trust – building trust is a central consideration of any EPE program. Once trust is lost it is difficult to win back. The proposed Barendrecht CCS project in the Netherlands is a case in point. Here the developer often seemed to be explaining and defending. An informant observed that the developers started to hold a public awareness event before it had the support of the local council. This oversight resulted in many stakeholders being unable to give their support to the project as they were unfamiliar with its details. This poor start compounded by other action led to early negative feelings and distrust amongst the local community. Projects must win over key stakeholders within local

communities, thereby giving the entire project more credibility. A contrasting story emerges from an Irish infrastructure project. The potential negative aspects of the project (particularly during the building phase) were made very clear to the local community. Indeed, not only was the likely disruption fully acknowledged, but it was presented in terms of the community taking ‘ownership’ by suffering inconvenience and in so doing contributing to the realization of the project.

Adopting a more open and transparent approach results in more successful engagement. Coupling that with the consult-consider-modify approach contributes to better decision-making by ensuring it is informed and responsive. It is increasingly accepted that public participation is important not just for the realization of individual projects, but also for improving public attitudes towards an organization or a sector, and in so doing preparing the way for the next education and public engagement process [36]. However, using ‘participatory’ language or claiming to adhere to notions of procedural, recognition (or even distributive) justice *etc.* does not necessarily mean that public engagement will develop trust or the building of good relationships. The insincerity of some EPE programs is often apparent to citizens, especially when key actors have a record of disingenuous engagements with communities. Even when the developer tries to engage in good faith, there may be different actors involved in the process, often with different understandings participation, who may attempt to impose their understanding on the participation processes [37].

We give the final word to one of our interviewees: ‘*Engagement techniques that focus on community concerns – and which are transparent, realistic and honest in what they can deliver – fall into my category of good practice and ones that don't fall into my bad practice category.*’

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